

WHAT IS CLAIMED IS:

1. A coordinate input apparatus for designating a particular set of coordinate in three-dimensional space, comprising:

a cylindrical magnet having a center axis;

an annular magnet having a center axis in common with the center axis of the cylindrical magnet and having an inner circumference larger than an outer circumference of the cylindrical magnet;

a plurality of magnetoelectric transducers disposed in a plane transverse to the common center axes of the cylindrical and annular magnets, wherein:

the cylindrical magnet and the annular magnet are disposed so that respective, identical magnetic poles thereof are in opposing relationship, and

the annular magnet is tiltable with respect to the cylindrical magnet and the plane of the magnetoelectric transducers, and

the magnetoelectric transducers detect a change in a magnetic field caused by tilting of the annular magnet relatively to the cylindrical magnet and the plane of the magnetoelectric transducers, so as to input two-dimensional coordinate values according to the detected change in the magnetic field.

2. The coordinate input apparatus as recited in claim 1, further comprising:

a holder fixedly mounted with respect to the cylindrical magnet and having a curved interior surface symmetrically disposed with respect to the common center axes of the cylindrical and annular magnets and surrounding both of the cylindrical and annular magnets; and

a slide support having an outer curved surface slidably engageable in mating relationship with the interior curved surface of the holder and supporting thereon the annular magnet; and

the cylindrical and annular magnets producing a force of repulsion therebetween, engaging the mating, outer curved surface of the slide support with the inner curved surface of the holder in a sliding relative relationship therebetween to afford rotation of the holder relatively to the slide support and corresponding tilting of the annular magnet with respect to the magnetoelectric transducers.

3. The coordinate input apparatus as recited in claim 1, wherein the cylindrical magnet is a substantially solid, cylindrical structure having parallel opposite ends perpendicular to the center axis thereof.

4. A coordinate input apparatus for designating a set of coordinates in three-dimensional space, comprising:

an annular magnet having a center axis;

a cylindrical magnet having a central axis in common with the center axis of the annular magnet and an outer circumference smaller than an inner circumference of the annular magnet;

a plurality of magnetoelectric transducers disposed in a plane transverse to the common central axes of the annular and cylindrical magnets, wherein:

the annular magnet and the cylindrical magnet are disposed so that respective, identical magnetic poles thereof are in opposing relationship, and

the cylindrical magnet is tiltable with respect to the annular magnet and the plane of the magnetoelectric transducers; and

the magnetoelectric transducers detect a change in a magnetic field caused by tilting of the cylindrical magnet relatively to the annular magnet and the plane of the magnetoelectric transducers, so as to input two-dimensional coordinate values according to the detected change in the magnetic field.

5. The coordinate input apparatus as recited in claim 4, further comprising:  
a holder fixedly mounted with respect to the annular magnet and having a curved interior surface symmetrically disposed with respect to the common center axes of the cylindrical and annular magnets and surrounding both of the cylindrical and annular magnets; and

a slide support having an outer curved surface slidably engageable in mating relationship with the interior curved surface of the holder and supporting thereon the annular magnet; and

the cylindrical and annular magnets producing a force of repulsion therebetween, engaging the mating, outer curved surface of the slide support with the inner curved surface of the holder in a sliding relative relationship therebetween to afford rotation of the holder relatively to the slide support and corresponding tilting of the cylindrical magnet with respect to the magnetoelectric transducers.

6. The coordinate input apparatus as recited in claim 4, wherein the cylindrical magnet is a substantially solid, cylindrical structure having parallel opposite ends perpendicular to the center axis thereof.

7. A coordinate input apparatus for designating a set of coordinates in three-dimensional space, comprising:

an annular magnet having a center axis;

a cylindrical magnet having a center axis in common with the center axis of the annular magnet and having an outer circumference smaller than an inner circumference of the annular magnet;

a plurality of magneto electric transducers disposed in a plane perpendicular to the common center axes of the cylindrical and annular magnets, wherein:

the annular magnet and the cylindrical magnet are disposed so that respective, identical magnetic poles thereof are in opposing relationship, and

the cylindrical magnet is tiltable with respect to the annular magnet; and

the magnetoelectric transducers detect a change in a magnetic field caused by tilting of the cylindrical magnet relatively to the annular magnet and the plane of the magnetoelectric transducers, so as to input two-dimensional coordinate values according to the detected change in the magnetic field.

8. The coordinate input apparatus as recited in claim 7, further comprising:

a holder fixedly mounted with respect to the annular magnet and having a curved interior surface symmetrically disposed with respect to the common center axes of the cylindrical and annular magnets and surrounding both of the cylindrical and annular magnets; and

a slide support having an outer curved surface slidably engageable in mating relationship with the interior curved surface of the holder and supporting thereon the cylindrical magnet; and

the cylindrical and annular magnets producing a force of repulsion therebetween, engaging the mating, outer curved surface of the slide support with the inner curved surface of the holder in a sliding relative relationship therebetween to afford rotation of the holder relatively to the slide support and corresponding tilting of the cylindrical magnet with respect to the magnetoelectric transducers.

9. The coordinate input apparatus as recited in claim 8, wherein the cylindrical magnet is a substantially solid, cylindrical structure having parallel opposite ends perpendicular to the center axis thereof.

10. A coordinates input apparatus for designating a set of coordinates in three-dimensional space, the coordinates input apparatus comprising:

first and second magnets having a common central axis and respective lines of magnetic flux in opposing relationship;

a plurality of magnetoelectric transducers disposed in a plane transverse to the common central axis, positional symmetrically thereabout and relatively to the opposing lines of magnetic flux, and displaced radially from the pole of at least one of the first and second magnets; and

the second magnet being tiltable relatively to the plane of the magnetoelectric transducers, angularly displacing the axis thereof relatively to the common central axis and the plane of the magnetoelectric transducers, and the magnetoelectric transducers outputting corresponding voltages having values that vary according to the magnitude of the tilt of the second magnet relatively to the plane of the magnetoelectric transducers, and producing output voltages having differential voltage values indicating a set of X-Y coordinates in two-dimensional space.

11. The coordinate input apparatus as recited in claim 10, further comprising:  
a holder fixedly mounted with respect to one of the first and second magnets and having a curved interior surface symmetrically disposed with respect to the common center axes of the first and second magnets and surrounding both of the first and second magnets; and

a slide support having an outer curved surface slidably engaging in mating relationship with the interior curved surface of the holder and supporting thereon the other of the first and second magnets; and

the first and second magnets producing a force of repulsion therebetween, engaging the mating, outer curved surface of the slider support with the inner curved surface of the holder in a sliding relative relationship therebetween to afford rotation of the holder relatively to the slide support and tilting of the other of the first and second magnets with respect to the other of the first and second magnets.

12. The coordinate input apparatus as recited in claim 10, wherein the first and second magnets are substantially identical, cylindrical magnets having flat end surfaces in a plane perpendicular to the common axes thereof.

13. The coordinate input apparatus as recited in claim 10, wherein the first magnet is a solid cylindrical magnet fixedly mounted to the holder; and  
the second magnet is an annular magnet carried by the slide support.

14. The coordinate input apparatus as recited in claim 10, wherein the first magnet is a solid cylindrical annular fixedly mounted to the holder; and

the second magnet is an cylindrical magnet carried by the slide support.

15. A coordinates input apparatus for designating a second of coordinates in three-dimensional space, as recited in claim 10, wherein:

the first and second magnets are each of a cylindrical configuration and have opposite poles in spaced relationship along the common central axis; and

the electromagnetic transducers are disposed in the plane, transverse to the common central axis and at a radius thereabout greater than a radius of the outer surface of the first and second magnets.

16. A coordinates input apparatus for designating a second of coordinates in three-dimensional space, as recited in claim 10, wherein:

the first and second magnets are annular in configuration with common, respective outer and inner diameters; and

the electromagnetic transducers are disposed symmetrically about the common central axis and radially inwardly of the inner diameters of the first and second magnets.

17. A coordinates input apparatus for designating a second of coordinates in three-dimensional space, as recited in claim 14, wherein the electromagnetic transducers are disposed along the common central axis at an axial position intermediate the opposed and spaced pole faces of the first and second magnets.

18. A coordinates input apparatus for designating a second of coordinates in three-dimensional space, as recited in claim 10, wherein:

the first magnet is cylindrical in configuration and the second magnet is annular in configuration, having an inner diameter greater than an outer diameter of the first magnet and disposed with opposite poles thereof at a common axial position along the common central axis; and

the electromagnetic transducers are disposed at a common radial distance from the common central axis so as to be symmetrically related to the second, annular magnet.

19. A coordinates input apparatus for designating a second of coordinates in three-dimensional space, as recited in claim 16, wherein the electromagnetic transducers are disposed in confronting relationship with the pole face of the annular, second magnet and at an intermediate axial position on the common central axis with respect to an axial dimension of the first, cylindrical magnet.

20. A coordinates input apparatus for designating a second of coordinates in three-dimensional space, as recited in claim 16, wherein the electromagnetic transducers are disposed in confronting relationship with the pole face of the annular, second magnet and at an axial position on the common central axis displaced from an axial dimension of the first, cylindrical magnet.

21. A coordinates input apparatus for designating a second of coordinates in three-dimensional space, as recited in claim 16, wherein the electromagnetic transducers are disposed radially outwardly of the second, annular magnet and at a common axial position relatively to the first, cylindrical magnet along the common central axis.



22. A coordinates input apparatus for designating a second of coordinates in three-dimensional space, as recited in claim 16, wherein:

the first magnet is annular in configuration and the second magnet is cylindrical in configuration and has an outer diameter less than an inner diameter of the first annular magnet and the first and second magnets are disposed with opposite pole faces thereof at a substantially common axial position along the common central axis; and

the electromagnetic transducers are disposed in confronting relationship with, and spaced from, the pole face of the cylindrical, second magnet and within a cylindrical interior of the first, annular magnet.